CLAIMS

What is claimed is:

1. A method to derive quantitative information on bone structure from a dental x-ray image comprising:

(a) obtaining a dental x-ray image, wherein the dental x-ray image includes (i) at least a portion of the maxilla or mandible and (ii) an external standard for determining bone structure; and

(b) analyzing the image obtained in step (a) to derive quantitative information on bone structure.

2. The method of claim 1, wherein the external standard comprises a calibration phantom that projects free of the mandible or maxilla.

3. The method of claim 2, wherein the calibration phantom comprises geometric patterns.

4. The method of claim 3, wherein the geometric patterns are plastic or metal.

5. The method of claim 4, wherein the geometric patterns are metal powder.

6. The method of claim 1, wherein step (b) comprises analyzing the image using one or more computer units.

7. The method of claim 6, wherein the analysis comprises identifying a region of anatomical interest in the image.

8. The method of claim 7, wherein the region of anatomical interest is in the mandible or the maxilla.

9. The method of claim 7, wherein the region of anatomical interest is a tooth.

10. The method of claim 1, wherein the method further comprises analyzing the image to obtain information on bone mineral density.

11. The method of claim 10, wherein the computer unit identifies structural or density information at a specified distance from the region of anatomical interest.

12. The method of claim 10, wherein the computer unit identifies areas in the image having selected structural or density characteristics.

13. The method of claim 12, wherein the selected density characteristic comprises the area of the image having the highest density.

14. The method of claim 12, wherein the selected density characteristic comprises the area of the image having the lowest density.

15. The method of claim 12, wherein the selected structural characteristic is selected from the group consisting of trabecular thickness; trabecular spacing; two-dimensional or three-dimensional spaces between trabecular; two-dimensional or three-dimensional architecture of the trabecular network.

16. The method of claim 1, wherein step (a) further comprises providing a hygienic cover adapted to receive the external standard.

17. The method of claim 16, wherein the hygienic cover is radiolucent.

18. The method of claim 16, wherein the hygienic cover is disposable.

19. The method of claim 16, wherein the hygienic cover is sterilizable.

20. The method of claim 16, wherein the external standard is integrated into the hygienic cover.

21. The method of claim 16, wherein the external standard is temporarily attached to the hygienic cover while obtaining the image.

22. The method of claim 16, wherein the hygienic cover further comprises a bolus in the path of the x-ray beam.

23. The method of claim 22, wherein the bolus is water-filled.

24. The method of claim 22, wherein the bolus is integrated into the hygienic cover.

25. The method of claim 22, wherein the bolus is temporarily attached to the hygienic cover.

26. The method of claim 6, wherein the computer unit includes one or more correction factors.

27. The method of claim 26, wherein the correction factors account for variation in soft-tissue thickness.

28. The method of claim 1, wherein obtaining the dental x-ray image further comprises compressing soft tissue in the image to a selected thickness.

29. The method of claim 1, wherein the x-ray image is an x-ray film.

30. The method of claim 16, wherein the hygienic cover is further adapted to receive x-ray film.

31. The method of claim 1, wherein the image is obtained digitally.

32. The method of claim 31, wherein the digital image is obtained using a selenium detector system or a silicon detector system.

33. A method to derive quantitative information on bone structure from an x-ray image comprising:

(a) obtaining an x-ray image; and

(b) analyzing the image obtained in step (a) using one or more indices selected from the group consisting of Hough transform, skeleton operator, morphological operators, mean pixel intensity, variance of pixel intensity, fourier spectral analysis, fractal dimension, morphological parameters and combinations thereof, thereby deriving quantitative information on bone structure.

34. The method of claim 33, wherein at least one of the indices is Hough transform.

35. The method of claim 33, wherein at least one of the indices is a skeleton operator.

36. The method of claim 33, wherein at least one of the indices is a morphological operator.

37. The method of claim 33, wherein at least one of the indices is mean pixel intensity.

38. The method of claim 33, wherein at least one of the indices is variance of pixel intensity.

39. The method of claim 33, wherein at least one of the indices is a Fourier transform analysis.

40. The method of claim 33, wherein at least one of the indices is fractal dimension.

41. The method of claim 33, wherein at least one of the indices is a morphological parameter.

42. An x-ray assembly for determining bone mineral density or bone structure comprising

(a) a hygienic cover;

(b) x-ray film and

(d) a calibration phantom comprising at least one marker positioned in an area of known density or structure.

43. The assembly according to claim 42, wherein the hygienic cover is disposable.

44. The assembly according to claim 42, wherein the hygienic cover is sterilizable.

45. The assembly according to claim 42, wherein the calibration phantom is integrated into the hygienic cover.

46. The assembly of claim 42, wherein the assembly further comprises an x-ray film holder and the calibration phantom is temporarily attached to the x-ray film holder or to the hygienic cover.

47. The assembly of claim 42, wherein the calibration phantom comprises a plurality of geometric patterns that serve as a reference for bone structure characteristics.

48. The assembly of claim 47, wherein the bone structure characteristics are selected from the group consisting of trabecular thickness; trabecular spacing; two-dimensional or three-dimensional spaces between trabecular; two-dimensional and three-dimensional architecture of the trabecular network.

49. The assembly of claim 47, wherein the geometric patterns are made of metal, metal powder or plastic.

50. The assembly of claim 47, wherein the marker is a geometric pattern selected from the group consisting of circles, stars, squares, crescents, ovals, multiple-sided objects, irregularly shaped objects and combinations thereof.

51. The assembly of claim 42, wherein the film is integral to the hygienic cover.

52. The assembly of claim 42, wherein the calibration phantom is integral to the x-ray film.

53. The assembly of claim 52, wherein the calibration phantom is included between two of the physical layers of the x-ray film.

54. The assembly of claim 52, wherein the calibration phantom is included within one of the physical layers of the x-ray film.

55. The assembly of claim 42, wherein the hygienic cover further comprises a bolus.

56. The assembly of claim 55, wherein the bolus is integral to the hygienic cover.

57. The assembly of claim 55, wherein the bolus is temporarily attached to the hygienic cover.

58. The assembly of claim 42, wherein the calibration phantom is adapted to fit over one or more teeth.

59. The assembly of claim 58, wherein the calibration phantom is V-shaped or U-shaped.

60. A method of accurately determining bone mineral density or bone structure of a dental x-ray image, the method comprising:

providing an assembly according to claim 35, wherein the calibration phantom is positioned such that x-rays pass through a subject and the calibration phantom simultaneously, wherein the image includes at least a portion of mandible or maxilla;

creating an image of the calibration phantom and the mandible or the maxilla; and

comparing the image of the calibration phantom and the subject's anatomy to determine bone mineral density of the subject.

61. A kit comprising a hygienic cover; a calibration phantom for bone structure or bone density comprising an integrated geometric pattern; an x-ray imaging assembly

and computer programs, wherein said computer programs analyze and assess bone mineral density or bone structure.

62. A method of diagnosing a bone condition comprising analyzing a dental x-ray obtained by the method of claim 1.

63. The method of claim 62, wherein the condition is osteoporosis.

64. A method of treating a bone condition comprising diagnosing the condition according to the method of claim 52, and administering a suitable treatment.

65. The method of claim 64, wherein the condition is osteoporosis.

66. The method of claim 65, wherein the treatment comprises administering an anti-resorptive agent or an anabolic agent.

67. An x-ray assembly for determining bone mineral density or bone structure comprising

(a) a hygienic cover;

(b) x-ray film and

(d) a calibration phantom for measuring bone mineral density or structure or combinations thereof.

68. The assembly according to claim 67, wherein the hygienic cover is disposable.

69. The assembly according to claim 67, wherein the hygienic cover is sterilizable.

70. The assembly according to claim 67, wherein the calibration phantom is integrated into the hygienic cover.

71. The assembly of claim 67, wherein the assembly further comprises an x-ray film holder and the calibration phantom is temporarily attached to the x-ray film holder or to the hygienic cover.

72. The assembly of claim 67, wherein the calibration phantom comprises a plurality of geometric patterns that serve as a reference for bone structure characteristics.

73. The assembly of claim 72, wherein the bone structure characteristics are selected from the group consisting of trabecular thickness; trabecular spacing; two-dimensional or three-dimensional spaces between trabecular; two-dimensional and three-dimensional architecture of the trabecular network.

74. The assembly of claim 67, wherein the geometric patterns are made of metal, metal powder or plastic.

75. The assembly of claim 67, wherein the marker is a geometric pattern selected from the group consisting of circles, stars, squares, crescents, ovals, multiple-sided objects, irregularly shaped objects and combinations thereof.

76. The assembly of claim 67, wherein the film is integral to the hygienic cover.

77. The assembly of claim 67, wherein the calibration phantom is integral to the x-ray film.

78. The assembly of claim 77, wherein the calibration phantom is included between two of the physical layers of the x-ray film.

79. The assembly of claim 77, wherein the calibration phantom is included within one of the physical layers of the x-ray film.

80. The assembly of claim 42, wherein the hygienic cover further comprises a bolus.

81. The assembly of claim 80, wherein the bolus is integral to the hygienic cover.

82. The assembly of claim 80, wherein the bolus is temporarily attached to the hygienic cover.

83. The assembly of claim 67, wherein the calibration phantom is adapted to fit over one or more teeth.

84. The assembly of claim 83, wherein the calibration phantom is V-shaped or U-shaped.